

REMARKS

Claims 1-11 and 14-16 are pending in this application. Claims 1-11 and 14-16 are canceled herein without prejudice. New Claims 17-29 are presented herein. Support for these new claims is found in the original claim language and throughout the specification, as set forth below. No new matter is added by the new claims and their entry is respectfully requested.

In light of these new claims and the following remarks, Applicants respectfully request reconsideration of this application and allowance of the pending claims to issue.

I. Claim 8

Claim 8, drawn to an invention nonelected with traverse, is contained in the application. Claim 8 has been canceled thereby addressing the Examiner's request.

II. Defective Declaration

The original declaration was objected to for failure to identify the city and either state or foreign residence of each inventor and for alterations that were not initialed or dated. *See* Final Office Action, page 2. Applicants have enclosed a new declaration with the present response, which corrects the inadvertent mistakes of the original declaration. Applicants respectfully request entry of this document.

III. Objection to the Abstract

The abstract was objected to as not being descriptive of the invention. *See* Final Office Action, page 2. The abstract has been amended by adding the sentence: "BiP levels can be increased above endogenous levels by over-expressing BiP or calreticulin." This amendment is believed to address the concerns of the Examiner, and Applicants respectfully request that the objection to the abstract be withdrawn.

IV. Rejection under 35 U.S.C. § 112, first paragraph

A. Enablement

Claims 1-7, 10-11 and 14-16 stand rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate with the scope of the claims. *See* Final Office Action, page 3-4.

Claims 1-7, 10-11 and 14-16 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

B. Written Description

Claims 1-7, 9-10 and 14-16 stand rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. The Final Office Action states that the claims contain subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. *See* Final Office Action, page 5.

Claims 1-7, 9-10 and 14-16 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

V. Rejection under 35 U.S.C. § 112, second paragraph

Claims 1-7, 9-11 and 14-16 stand rejected under 35 U.S.C. § 112, second paragraph as allegedly failing to point out and distinctly claim the subject matter of the invention. *See* Final Office Action, page 5-6.

Claims 1-7, 9-11 and 14-16 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

VI. Rejection under 35 U.S.C. § 102

A. Claims 1-2 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Crofts et al. (*Plant Cell* 10:813-823, 1998). See Final Office Action, page 6-7.

Claims 1-2 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

B. Claims 1-4, 10-11 and 14-15 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Arora et al. (*Physiol. Planta.* 103:24-34, 1998). See Final Office Action, page 8.

Claims 1-4, 10-11 and 14-15 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

C. Claims 1-4, 10-11 and 14-15 are rejected under 35 U.S.C. § 102(b) as being anticipated by Zhang et al. (*Protoplasma* 171:142-152, 1992). See Final Office Action, page 8.

Claims 1-4, 10-11 and 14-15 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

VII. Rejection under 35 U.S.C. § 103(a)

A. Claims 1-7, 10-11 and 14-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Crofts et al. (*Plant Cell* 10:813-823, 1998). See Final Office Action, page 9.

Claims 1-7, 10-11 and 14-15 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

B. Claims 9 and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Crofts et al. (*Plant Cell* 10:813-823, 1998) and in further view of Denecke et al. (*Plant Cell* 7:391-406 (1995)). See Final Office Action, page 9-10.

Claims 9 and 16 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

C. Claims 1-4, 6, 10-11 and 14-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Coughlin et al. (U.S. Pat. No. 6,171,864). See Final Office Action, page 10.

Claims 1-4, 6, 10-11 and 14-15 are canceled herein without prejudice, thereby mooting this rejection, and Applicants respectfully request its withdrawal.

VIII. Amendments to the Specification (Examples)

Amendments were made to several of the Examples to correct clerical errors and inadvertent mistakes made when the figures were referenced.

Example 6

Example 6, page 17, lines 37 through page 18, line 1, refers to Figure 7 and is now amended to refer to Figure 6. The discussion in Example 6 concerns treatment with tunicamycin. Figure 6 illustrates tunicamycin treatment and is the correct figure to be referenced here.

Example 11

Example 11, page 20, lines 31-32 refers to Figure 10 and is now amended to refer to Figure 11. Here, the Example 11 discussion concerns induction of BiP and PR1 expression following treatment of a *saiI* mutant with salicylic acid. This is depicted in Figure 11, not in Figure 10.

Example 11, page 20 lines 34 through page 21, line 2, refers to Figure 10 and is amended to refer to Figure 7. Here, Example 11 compares BiP and PR1 expression in tobacco to that of the Arabidopsis *saiI* mutant, following treatment with salicylic acid. Figure 7 illustrates expression profiles for BiP and PR1 in tobacco in response to salicylic acid treatment. Thus, Figure 7 is the figure that should be referred to in this instance.

Example 12

Example 12, page 21, lines 19-21, refers to Figure 11 and is amended to refer to Figure 12. Example 12 discusses BiP and PR1 expression in BiP-overproducing transgenic plants as compared to wild-type plants. This is illustrated in Figure 12 not Figure 11.

Example 12, page 21, lines 21-24, refers to Figure 11 and is amended to refer to Figure 12. Here, Example 12 also compares transgenic BiP overproducing tobacco plants with wild-type plants. This is illustrated in Figure 12, not Figure 11.

Example 13

Example 13, page 21, line 35 through page 22, line 1, refers to Figure 12A and is amended to refer to Figure 13A. The reference in Example 13 is to a plasmid construct. Figure 13A depicts the plasmid construct as discussed in Example 13.

Example 13, page 22, lines 4-7, refers to Figure 12B and is amended to refer to Figure 13B. Here, Example 13 discusses the effect of tunicamycin on α -amylase and GUS activity. This is illustrated in Figure 13B.

Example 14

Example 14, page 22, lines 33-34, refers to Figure 13A and is amended to refer to Figure 14A. Example 14 discusses correlations of α -amylase activity with GUS activity which is illustrated in Figure 14 A.

Example 14, page 22, lines 35-36, refers to Figure 12 and is amended to refer to Figure 14B. Example 14 discusses PAT coexpression. This is depicted in Figure 14B and not Figure 12.

Example 14, page 23, lines 2-5, refers to Figure 13B and is amended to refer to Figure 14B. Here, Example 14 discusses the effects of BiP overexpression and tunicamycin treatment on α -amylase activity. This is illustrated in Figure 14B and not Figure 13B.

Example 15

Example 15, page 23, lines 11-13, refers to Figure 14 and is amended to refer to Figure 15. Example 15 discusses transcripts levels. This is illustrated in Figure 15, not Figures 14A or 14B.

Example 15, page 23, lines 17-19, refers to Figure 12 and is amended to refer to Figure 15. Here, in Example 15 the discussion concerns the reduction in secretory protein synthesis. This is illustrated in Figure 15, not Figure 12A or 12B. Thus, the correct figure to be referenced in this instance is Figure 15.

Example 16

Example 16, page 23, line 25-27, refers to Figure 15A and is amended to refer to Figure 16A. Example 16 discusses BiP overexpression in transgenic tobacco protoplasts and the effect of tunicamycin induced ER stress. This is illustrated in Figure 16A.

Example 16, page 23, lines 27-29, refers to Figure 15B and is amended to refer to Figure 16B. Here, Example 16 is discussing overexpression of a BiP derivative lacking an ER retention signal. Figure 16B illustrates the response of the BiP overexpressing derivative lacking an ER retention signal. Figure 15B does not exist.

IX. New Claims 17-29

New Claims 17-29 are presented herein for examination in this application and are directed toward a method of accelerating a plant's response to attack by a plant pathogen as recited therein. Support for these new claims is found throughout the specification, as noted above, and no new matter is added by these new claims.

Applicants believe that the new claims are free of the Examiner's prior rejections because these claims are directed to embodiments not deemed to be anticipated or rendered obvious by the references cited by the Examiner. Furthermore, Applicants believe that the subject matter of the new claims to be patentable in view of the declaration under 37 C.F.R. §1.132, provided by the inventor and submitted with this response.

Dr. Denecke states in his declaration that one skilled in the relevant art would recognize that multiple BiP's, both plant and non-plant, were known in the art at the time the present invention was filed. He also states that a high level of functional complementation was known to exist between the BiP from these various organisms. Thus, Applicants respectfully submit that the present invention would have been enabled for BiP's other than tobacco at the time of the filing. Additionally, it is noted that the specification of the present application, on page 14, line 1-4, discloses that BiP overproduction in potatoes causes resistance to soft rot.

Dr. Denecke further asserts that, rather than recognizing that increased BiP levels would lead to an accelerated response to pathogen attack, one of ordinary skill in that art would have concluded from the cited reference that increased BiP levels were instead the result of infection and increased production of defense-related proteins. Accordingly, Applicants respectfully submit that new Claims 17-29 are not anticipated or rendered obvious by the reference Crofts et al. (*Plant Cell* 10:813-823, 1998), and respectfully request that this rejection be withdrawn.

All of the issues raised in the Final Office Action are addressed herein. Thus, Applicants believe that the claims presented herein are free of the prior art and define patentable subject matter. The Examiner is invited and encouraged to contact the undersigned directly if such contact will expedite the prosecution of the pending claims to issue.

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Serial No. 09/868,434
Filed: January 10, 2002
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A check in the amount of \$1320.00 (\$980.00 as fee for a three month extension of time and \$340.00 Notice of Appeal fee) is enclosed. This amount is believed to be correct; however the Commissioner is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account 50-0220.

Respectfully submitted,



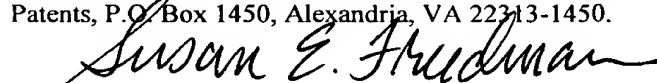
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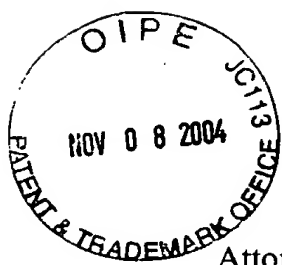
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Susan E. Freedman
Date of Signature: November 8, 2004



Attorney Docket No. 9052-84

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Jurgen Denecke
Serial No.: 09/868,434
Filed: June 15, 2001

Group Art Unit: 1638
Examiner: A. Kubelik

For: *ENHANCING PLANT PATHOGEN RESISTANCE VIA INCREASING BIP LEVELS*

October 5, 2004

Commissioner for Patents
Post Office Box 1450
Alexandria, Virginia 22313-1450

DECLARATION UNDER 37 C.F.R § 1.132
OF JURGEN DENECKE, PhD.

Sir:

I, Jurgen Denecke PhD, do hereby declare and say as follows:

1. I received a Bachelor of Science degree (B.Sc) in Agricultural and Chemical Engineering from the University of Brussels, Belgium in 1986 and a Doctor of Philosophy degree (PhD.) from the University of Ghent in 1991. I am currently a Reader in the School of Biology at the University of Leeds, United Kingdom.

Additionally, I have delivered numerous lectures and authored and co-authored numerous articles and books in the areas of plant biotechnology, I am a named inventor for the present application and am knowledgeable of the contents of the above-identified patent application. I am also a co-author for the Crofts et al citation.

2. One of ordinary skill in the art of plant biochemistry would be apprised that at the time of filing the present application several non plant BiPs were in the public domain. For example BiPs had been identified in *Saccharomyces cerevisiae*, *Aspergillus*,

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nematode worms, chicken, chinese hamsters and mice. BiPs were also known before December 1998 in *Arabidosis thaliana*, soybean, rice, maize, spinach and tobacco. (Please refer to Appendix I filed herewith for further details of BiPs in the public domain prior to December 1998). Therefore, the present application is adequately enabled for BiPs other than tobacco. Moreover, the high level of conservation was most rigorously demonstrated already in 1991 by my own experiments in which tobacco BiP was shown to functionally complement BiP in the yeast *Saccharomyces cerevisiae*. Tobacco BiP could fully replace the essential yeast BiP and sustain a viable strain (Denecke et al., 1991. *The Plant Cell* **3**, 1025-1035). One of ordinary skill in the art of plant biochemistry deduces from the high degree of conservation of BiP, even between kingdoms of organisms, that BiP from any eukaryotic cell, not just tobacco, would be sufficient to perform the invention. Indeed, even an artificially designed BiP which differs from any BiP in any given species would be appropriate so long as it possessed BiP activity.

I believe it would be possible for a competitor to develop plants and seeds from a plant over-expressing another BiP, for example a chicken BiP (see Appendix 1 example Stoeckle et al *Mol. Cell. Biol.* **8**, (7), 2675-2680, (1988)). This would bypass the present invention if it were limited to tobacco BiP. One of ordinary skill in the art of plant biochemistry would appreciate that a protein and its activity is what is crucial to the present invention not a nucleic acid sequence and a percentage of sequence identity.

Adequate definitions of "BiP Activity" are in the public domain and mainly illustrated in (Denecke et al., 1991. *The Plant Cell* **3**, 1025-1035) but also in (Leborgne-Castel et al., 1999. *The Plant Cell* **11**, 459-470). Indeed, the findings illustrated in Figure 12A on accelerated induction of PR1 (at 6 hours in BiP overproducers compared to 24 hours in wild type), or Figures 13 and 14 on the BiP-overexpression mediated resistance to the drug tunicamycin could also be used as routine methods of testing BiP activity.

Thus, in the present context, the specification supports the statement that the method of the present invention can be performed by over-expression of any BiP, not just plant BiPs and certainly not just BLP4.

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3. I am a co-author of Crofts et al 1998, The Plant Cell, Vol 10, 813-823 May 1998. The disclosure in the paper does not recognise plants having increased levels of BiP or methods of increasing such protein levels would result in an accelerated response to pathogen attack or infection. Indeed, one of ordinary skill would have concluded that BiP induction may be a consequence of stress occurring from the increased production of defense related proteins. The opposite is shown to occur based on several key findings in the application as filed, including:

1) BiP gene induction occurs prior to the induction of defense-related proteins (Figure 1A) and is unrelated to the unfolded protein response (Figure 4). These findings were published and confirmed in Jelitto-Van Dooren et al., 1999. Plant Cell 11, 1935-1943, a date one year after the priority date of the present patent application and could not be deduced from the Crofts et al., 1998 disclosure.

2) An independent assay based on the plant signalling molecule salicylic acid showing that BiP synthesis occurs much earlier than PR1 synthesis and must therefore be due to a novel mechanism (Figure 7). This finding could not be deduced from Crofts et al., 1998 disclosure.

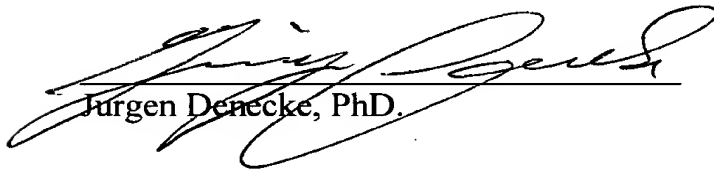
3) The finding that BiP over expression leads to accelerated induction of defence related proteins, illustrated by the complete induction of PR1 after merely 6 hours in BiP overproducing plants in contrast to 24 hours in wild type plants (Figure 12A), which led to the novel working model (Figure 17) which is the main foundation to the invention.

Such findings are not disclosed in Crofts et al 1998, The Plant Cell, Vol 10, 813-823 May 1998, moreover neither one of ordinary skill in the art of plant biochemistry or plant pathology, nor the authors of Crofts et al., 1998 themselves could have deduced or predicted such unexpected findings.

4. I believe that the present invention is not only fully supported for methods of overexpressing any BiP but that increased levels of BiP conferring a plant with an accelerated response time to pathogen attack is not disclosed in the prior art nor is the effect of BiP predictable.

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5. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.


Jurgen Denecke, PhD.

05/10/2004
Date

Appendix I Overview of BiP sequences in the public domain

A1a. Examples of non-plant BiPs published before filing in December 1998

***Saccharomyces cerevisiae* (brewers yeast)**

Rose MD, Misra LM, Vogel JP.

KAR2, a karyogamy gene, is the yeast homolog of the mammalian BiP/GRP78 gene. Cell. 1989 Jun 30;57(7):1211-21.

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1 mffnrlsagk llvplsvvly alfvvilplq nsfhssnvlv
41 rgaddvenyg tvigidlgtt yscvavmkng kteilaneqg
81 nritpsyvaf tdderligda aknqvaanpq ntifdikrli
121 glkyndrsdq kdikhlpfnv vnkdgkpave vsvkgekkvf
161 tpeeisgmil gkmkqiaedy lgtkvthavv tpayfndaq
201 rqatkdagti aglnvlrinv eptaaaiayg ldkdkehqi
241 ivydlgggtf dvslsieng vfevqatsgd thlggedfdy
281 kivrqlikaf kkkhgidvsd nnkalaklkr eaekakrals
321 sqmstrieid sfvdgidlse tltrakfeel nldlfkktlk
361 pvekvldqsg lekdvddiv lvggstripk vqqllesyfd
401 gkkaskginp deavaygaav qagvlsgeeg vedivlldvn
441 altlgiettg gvmtplikrn taipkksqi fstavdnqpt
481 vmikvyeger amskdnllg kfeltgippa prgvpqievt
521 faldangilk vsatdkgtgk sesititndk grltqeeidr
561 mveeaekfas edasikakve srnklenyah slknqvngdl
601 gekleedke tlldaandvl ewlddnfeta iaedfdekfe
641 slskvaypit sklyggadgs gaadyddede dddgdyfehd
681 el
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***Aspergillus* (filamentous mold)**

Hijarrubia, M. J., Casqueiro, J., Gutierrez, S., Fernandez, F. J., and Martin, J. F. Characterization of the bip gene of *Aspergillus awamori* encoding a protein with an HDEL retention signal homologous to the mammalian BiP involved in polypeptide secretion. Curr Genet 32, 139-46 (1997).

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1 marishqgaa kpftawttif ylllvfiapl affgtahaqd
41 etspqesygt vigidlgty scvgvmqngk veilvndqgn
81 ritpsyvaft deerlvгда knqyaanpr r t f d i k r l i g
121 rkfdkdvqk dakhfpykvv nkdgkphvkv dvnqtpkltl
161 peevsamvlg kmkeiaegyl gkkvthavv tpayfndaqr
201 qatkdagtia glnlrvvne ptaaaiaagl dktgderqvi
241 vydlgggtfd vsllsidngv fevlatagdt hlgedfdqr
281 vmdhfvklyn kknnvdtkd lkamgklkre vekakrtlss
321 qmstrieiea fhngedfset ltrakfeeln mdlfkktlkp
361 veqvlkdakv kksevddivl vggstripkv qalleeffgg
401 kkaskginpd eavafgaavq ggvlsggegt gdvvldmvp
441 ltlgiettg vmtkliprnt viptrksqif staadnqptv
481 liqvyegers ltkdnllgk feltgippa rgvpqievsvf
521 dldangilkv hasdkgtgka esititndkg rlsqeeidrm
561 vaeaeefae dkaikakiea rntlenyafs lknqvndeng
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601 lggqideddk qtildavkev tewlednaat attedfeeck
641 eqlsnvaypi tsklygsapa deddepsghd el

Nematode worm

Wilson,R.

Genome sequence of the nematode *C. elegans*: a platform for
investigating biology. The *C. elegans* Sequencing Consortium
JOURNAL Science 282 (5396), 2012-2018 (1998)

1 mktlflgli alsavsvyce eeektekket kygtiigidl gttyscvgy kngrveiian
61 dqgnritpsy vafsgdqgdr ligdaaknql tinpentifd akrigrdyn dktvqadikh
121 wpfkvidksn kpsvevkvg dnkqftpeev samvlvkmke iaesylgkev knavvtvpay
181 fndaqrqatk dagtiaglnv vriineptaa aiaygldkkd gernilvfdl gggtfdvsml
241 tidngvfevl atngdthlgg edfdqrmey fiklykkksg kdlrkdkrav qklrreveka
301 kralstqht kveieslfdg edfsetltra kfeelnmdlf ratlcpvqkv ledsdlkkdd
361 vheivlvgs tripkvqqli keffngkeps rginpdeava ygaavqggvi sgeedtgeiv
421 lldvnpltmg ietvggvmk ligmtvipt kksqvfstaa dnqptvtiqv fegerpmtkd
481 nhqlgkfdlt glppaprgvp qievtfeidv ngilhvtad kgtgnknkit itndqnrlsp
541 edierminda ekfaeddkkv kdkacarnel esaynlnq iedkeklgk ldeddkkie
601 eaveeaiswl gsnaeasae lkeqkkdles kvqipvskly kdagaggea peegsddkde
661 l

Chicken

Stoeckle,M.Y., Sugano,S., Hampe,A., Vashistha,A., Pellman,D. and
Hanafusa,H.

78-kilodalton glucose-regulated protein is induced in Rous sarcoma
virus-transformed cells independently of glucose deprivation
Mol. Cell. Biol. 8 (7), 2675-2680 (1988)

1 mrhlallll lggaraddee kkedvgtvvg idlgttyscv gvfkngrvei iandqgnrit
61 psyvaftpeg erligdaakn qltsnpentv fdakrligrt wndpsvqqdi kylpfkvvek
121 kakphiqv dv gggqtktfap eeisamvltk mketaeaylg kkvtHAVVTV payfndaqrq
181 atkdagtiag lnmriinep taaaiaygd kregekniv fdlgggtfdv sltidngvf
241 evvatngdth lggedfdqrv mehfiklykk ktgkdvrkdn ravqklrrev ekakralssq
301 hqarieiesf fegedfsetl trakfeelnm dlfrstmkp vqkvsdlk ksdideivlv
361 ggstripkiq qlvkeffngk epsrginpde avaygaavqa gvlsgdqtg dlvlldvcpl
421 tlgietvggv mtklipntv vptkksqifs tasdnqptvt ikvyegerpl tkdnhlgtf
481 dltgippapr gvpqievtfe idvngilrvt aedkgtgnkn kititndqnr ltpееiєrmv
541 ndaekfaeed kklkeridar nelesyaysl knqigdkekl ggklssedke tiekaveeki
601 ewleshqdad iedfkskkke leevvqpivs klygsagppp tgeeeaaekd el

Chinese Hamster

Ting,J., Wooden,S.K., Kriz,R., Kelleher,K., Kaufman,R.J. and
Lee,A.S.

The nucleotide sequence encoding the hamster 78-kDa
glucose-regulated protein (GRP78) and its conservation between
hamster and rat
Gene 55 (1), 147-152 (1987)

1 mkfpmvaaa lllcavraee edkkedvgtv vgidlggtys cvgvfkngrv eiiandqgnr
 61 itpsyvaftp egerligdaa knqltsnpen tvfdakrlig rtwndpsvqq dikflpfkvv
 121 ekktkpyiqv digggqtktf apeeisamvl tkmketaey lgkkvthavv tpayfndaq
 181 rqatkdagti aglnvmriin eptaaaiayg ldkregekni lvfdlgggtf dsvlltidng
 241 vfevvatngd thlggedfdq rvmehfikly kkkgtgkdvrk dnrvqklrr evekakrals
 301 sqhqarieie sffegedfse tltrakfeel nmdlfrstmk pvqkvledsd lkksdideiv
 361 lvggstripk iqqlvkeffn gkepsrginp deavaygaav qagvlsgdq tgdlvlldv
 421 pltlgietyg gvmtkliprn tvvptkksqi fstasdnqpt vtikvyeger pltkdnhlhg
 481 tfdlgtippa prgvpqievt feidvngilr vtaedkgtgn knkititndq nrltpeeier
 541 mvndaekfae edkklkerid trnelesyay slknqigdk klggklssed ketmekavee
 601 kiewleshqd adiedfkakk keleeivqpi isklygsagp pptgeedtse kdel

Mouse

Kozutsumi, Y., Normington, K., Press, E., Slaughter, C., Sambrook, J. and Gething, M.J.

Identification of immunoglobulin heavy chain binding protein as glucose-regulated protein 78 on the basis of amino acid sequence, immunological cross-reactivity, and functional activity

J. Cell Sci. Suppl. 11, 115-137 (1989)

1 mmkftvaaa llllgavrae eedkkedvgt vvgidlggtty scvgvfkngv veiiandqgn
 61 ritpsyvaftp egerligdaa knqltsnpe ntvfdakrli grtwnpsvq qdikflpfkv
 121 vektkpyiqv vdiggqtktf fapeeisamv ltkmketaea ylgkkvthav vtpayfnda
 181 qrqatkdagt iaglnvmrii neptaaaiay gldkregekn ilvfdlgggt fdvlltidn
 241 gvfevvatng dthlggedfd qrvmebfikl ykkgtgkdvr kdnrvqklr revekakral
 301 ssqhqariei esffegedfs etltrakfee lnmldfrstm kpqkvleds dlksdidei
 361 vlvggstrip kiqqlvkeff ngkepsrgin pdeavaygaa vqagvlsgdq dtgdlvlldv
 421 cpltlgiety ggvmtklipr ntvvptkksq ifstasdnqp tvtikvyege rpltkdnhlh
 481 gtfdltgipp aprgvpqiev tfeidvngil rvtaedkgtg nknkititnd qnrlteeie
 541 rmvndaekfa eedkklkeri dtnelesya yslknqigdk eklggklsse dketmekave
 601 ekiewleshq dadiedfkak kkeleeivqp iisklysgg ppptgeedts ekdel

AIb. A selection of plant BiP sequences published before filing in December 1998

Cloning of tobacco BiP in 1991 was the first evidence for multigene families for this class of protein in plants, accompanied by functional complementation in the yeast *Saccharomyces cerevisiae*, which represents a cross-Kingdom complementation and demonstrates extreme functional conservation. Tobacco BiP contains 8 or more isoforms which are over 90% identical. The patent is based on experiments conducted on isoform 4 (BLP4), but the other isoforms are exchangeable. At the time of filing, it was clear to anybody in the field that functional complementation between a plant BiP and yeast BiP demonstrates functional conservation so that any BiP could be used.

Tobacco BiP isoform BLP4 (one of 8 cloned isoforms)

Denecke, J., Souza Goldman, M.H., Demolder, J., Seurinck, J. and Botterman, J. (1991).
The tobacco luminal binding protein is encoded by a multigene family. *The Plant Cell* 3,
1025-1035.

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1 maggawnrrt slivfgivlf gclfafsiat eatklgtvi gidlgttysc vgvyknghve
61 iandqgnri tpswvaftdg erligeaakn laavnpertv fdvkrigrk fddkevqrdm
121 klvpykivnk dgkpyiqvki kdgetkifsp eeisamiltk mketaeaylg kkikdavvtv
181 payfndaqrq atkdagviag lnvariinep taaaiaygld kkggeknilv fdlgggtfdv
241 siltidngvf evlstngdth lggedfdqri meyfikklikk khgkdiskdn ralgklrrea
301 erakralssq hqvrveiesl fdgvdfsepl trarfeelnn dlfrktmgpv kkamddagle
361 ktqideivlv ggstripkvq qlldyfdgk epnkgvnpde avaygaavqg gilsgeggde
421 tkdillldva pltlgietvg gvmtkliprn tviptkksqv fityqdqqt vtiqvfefer
481 sltkdcrlig kfdltgiapa prgtpqievt fevdangiln vkaedkasgk sekititndk
541 grlsqeeier mvkeaeefae edkkvkerid arnsletyvy nmrnqindkd kladklesde
601 kekietatke alewlldnqs aekedyekl keveavcnpi itavyqksgg apggesgase
661 dddhdel
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***Arabidopsis thaliana* (one of three isoforms in this species)**

Koizumi, N.

Isolation and responses to stress of a gene that encodes a luminal binding protein in
Arabidopsis thaliana

Plant Cell Physiol. 1996

Volume 37

862-865

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1 marsfganst vvlaiiffgc lfafstakee atklgsvigi dlgttyscvg vyknghveii
61 andqgnritp swvgftdser ligeaaknqa avnpertvfd vkrligrkfe dkevqkdrkl
121 vpyqivnkdg kpyiqvkikd getkvfspee isamiltkmk etaeaylgkk ikdavvtvpa
181 yfndaqrqat kdagviagln variinepta aaiaygldkk ggeknilvfd lgggtfdvsv
241 ltidngvfev lstngdthlg gedfdhrime yfiklikkkh qkdiskdnka lgklrrecer
301 akralsqhq vrveieslfd gvdlsepltr arfeelnndl frktmgpvkk amddaglgks
361 qideivlvgg stripkvqq lkdffegkep nkgvnpdeav aygaavqggi lsgeggdetk
421 dillldvap ltlgietvggv mtklipmntv iptkksqvft tyqdqqtvs iqvfegersl
481 tkdcslgkf dltgvppapr gtpqievtfe vdangilnvk aedkasgkse kititnekgr
541 lsqeeidrmv keaeefaeed kkvkekidar naletyvynm knqvskdkl adklegdeke
601 kieaatkeal ewldenqnse keeydeklke veavcnpiit avyqrsggap gaggesstee
661 edeshdel
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***Glycine max* (Soybean)**

Figueiredo, J.E.F., Cascardo, J.M., Carolino, S.M.B., Alvin, F. and
Fontes, E.P.B.

Water-stress regulation and molecular analysis of the soybean BIP
gene family

Braz. J. Plant Physiol. 9, 103-110 (1997)

1 magswarrsl ivlaiisfgc lfaisiakee atklgtvigi dlgttyscvg vykngheii
 61 annqgnritp swvaftdser ligeaaknla avnpertifd vkrigrkfe dkevqrdmkl
 121 vpykivnkdg kpyiqvkikd getkvfspee isamiltkmk etaeafgkk indavvtvpa
 181 yfndaqrqat kdagviagln variinepta aaiaygldkk ggeknilvfd lgggtfdvsi
 241 ltidngvfev latngdthlg gedfgqrime yfiklikkkh gkdiskdnra lgklrreaer
 301 akrallssqh qvrveieslfd gvdfepltr arfeelnndl frktmgpvkk amedaglkqs
 361 qideivlvvg stripkvqql lkdyfdgkep nkgvnpdeav aygaavqegi lsgeggeetk
 421 dillldvaplt lgienvggv mtkliprntv iptkksqvft tyqdqqtvs iqvfegersl
 481 tkdcrllgkf dlsgippapr gtaqievtfe vdangilnvk aedkgtgkse kititnekgr
 541 lsqeeiervm reekdfaeek kvkeridar nsletyvynm knqvsdkdkl adklesdeke
 601 kietavkeal ewlddnqsme kedyeeekle veavcnpiis avyqrs gap ggggasgeed
 661 eddshdel

Rice

Muench,D.G., Wu,Y., Zhang,Y., Li,X., Boston,R.S. and Okita,T.W.
 Molecular cloning, expression and subcellular localization of a BiP
 homolog from rice endosperm tissue
 Plant Cell Physiol. 38 (4), 404-412 (1997)

1 mdrvrgsafl lgvllagslf afsvakeetk klgtvigidl gttyscvgy knghveiian
 61 dqgnritpsw vaftdserli geaaknqaav npertifdvk rdigrkfeek evqrdmklvp
 121 ykivnkigkp yiqvkikdge nkvsfpeevs amilgkmmet aeaylgkkin davvtvpayf
 181 ndaqrqatkd agviaglnva riineptaaa iaygldkkkg eknilvfdlg ggtfdvsilt
 241 idngvfevla tngdthlgge dfdqrimyef iklikkkysk diskdnralg klrreaerak
 301 ralsnqhqr veieslfdgt dfsepltrar feelnndlfr ktmgpkvkkam ddagleksqi
 361 heivlvvgst ripkvqqlr dyfegkepnk gvnnpdeavay gaavqgsils geggdetkdi
 421 lldvapltl gietvggvm kliprntvip tkksqvftty qdqqtvs iqvfegersmtk
 481 dcrllgkfdl sgipaaprgt pqievtfevd angilnvkae dkgtgkseki titnekgrls
 541 qeeidrmvre aeefaeedkk vkeridarnq letyvynmkn tvgdkdklad kleseekekv
 601 eealkealew ldenqtaeke eyeekleke avcnpiisav yqrtggapgg rrrgrlddeh
 661 del

Maize

Wrobel,R.L., OBrian,G.R. and Boston,R.S.
 Comparative analysis of BiP gene expression in maize endosperm
 Gene 204 (1-2), 105-113 (1997)

1 mdrvrgsafl lgvllagslf afsvakeetk klgtvigidl gttyscvgy knghveiian
 61 dqgnritpsw vaftdserli geaaknqaav npertifdvk rligrkfkd evqrdmklvp
 121 ykiinkdgkp yiqvkikdge nkvsfpees amilgkmmkt aeaylgkkin davvtvpayf
 181 ndaqrqatkd agviaglnva riineptaaa iaygldkkkg eknilvfdlg ggtfdvsilt
 241 idngvfevla tngdthlgge dfdqrimyef iklikkkysk diskdnralg klrreaerak
 301 ralsnqhqr veieslfdgt dfsepltrar feelnndlfr ktmgpkvkkam edagleksqi
 361 heivlvvgst ripkvqqlk dyfngkepnk gvnnpdeavaf gaavqgsils geggdetkdi
 421 lldvapltl gietvggvm kliprntvip tkksqvftty qdqqtvs iqvfegersmtk
 481 dcrllgkfdl ngipsaprgt pqievtfevd angilnvkae dkgtgkseki titnekgrls
 541 qeeidrmvre aeefaeedkk vkeridarnq letyvynmkn tvgdkdklad kleaeekv
 601 eealkealew lddnqsaeke dyeekleke avcnpiisav yqrs gap dadggvddd

Spinach

Anderson, J. V., Neven, L. G., Li, Q. B., Haskell, D. W. and Guy, C. L.

A cDNA encoding the endoplasmic reticulum-luminal heat-shock protein from spinach (*Spinacia oleracea* L.)

Plant Physiol. 104 (1), 303-304 (1994)

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1 mavawksras siafgivllg slfafvsakd eapklgtvig idlgttyscv gvykdgkvei
61 iandqgnrit pswvaftnde rligeaaknq aanpertif dvkrligrkf edkevqkdmk
121 lvykivnrd gkpyiqvkvq egetkvfspe eisamiltkm ketaetflgk kkdavvtvp
181 ayfndaqrqa tkdagviagl nvariinept aaaiaygldk rggeknilvf dlgggtfdvs
241 vltidngvfe vlatngdthl ggedfdqrlm eyfiklikkk htkdiskdnr algklrrece
301 rakralssqh qvrveieslf dgvdseplf rarfeelnnd lfrktmgpvk kamddaglek
361 nqideivlvq gstripkvqq llkeffngke pskgvnpdea vafgaavqgs ilsgeggeet
421 keillldvap ltlgietvgg vmtkliprnt viptkksqvf ttyqdqqtv tiqvfegeers
481 ltkdcrllgk fdltgiapap rgtpqievtf evdangilnv kaedkasgks ekititndkg
541 rlsqeeierm vreaeefae dkkvkekida rnsletyyn mknqisdadk ladklesdek
601 ekiegavkea lewlddnqsa ekedydeklk eveavcnpii tavyqrsggp sgesgadsed
661 seeghdel

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